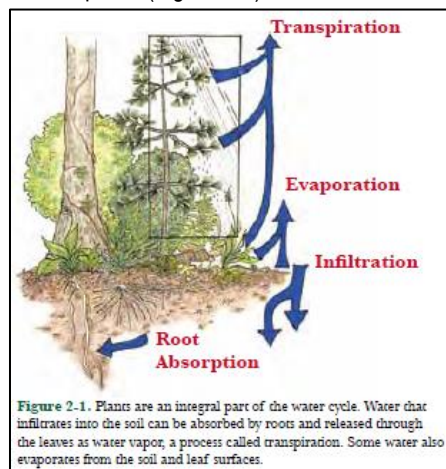


Water conservation assessment – New Hampshire “Follow the flow” process

- Go with the flow: understanding how water moves onto, through and away from your lakeshore site:
 - ✓ Controlling water runoff should be a major objective of any shoreland landscape design. As water collects and flows through channels, it gathers energy for its erosive force. The faster water flows, the greater the particle size and quantity of pollutants it can carry along to the receiving water body (pond, lake, stream, river, wetland or Great Lakes water).
 - ✓ As noted earlier, modifying the landscape with any type of development has the potential to degrade soil and water, resulting in changes in water flow, nutrient- and pollutant-loading, and groundwater recharge. However, if you start with a plan that takes into consideration the specific water runoff situation on your site, your new landscape could even improve the quality of the water coming off it.
 - ✓ This chapter will guide you through the process of assessing your current runoff situation and offer various strategies you can use to minimize the runoff from your site. Combining these approaches with appropriate choices of plants and horticultural products are the keys to ensuring a healthy shoreland environment.
- Common runoff control strategies:
 - ✓ Detention - holding back or “ponding” a volume of water to slow the speed of its outflow. In some cases water detention may also allow for infiltration and/or evaporation to reduce the final outflow volume.
 - ✓ Diversion - preventing water from traveling over the area of concern, thereby reducing surface runoff and minimizing the potential for erosion and the transport of nonpoint source pollutants.
 - ✓ Flow spreading - allowing a concentrated flow to spread out over a wide, gently sloped area to reduce the water velocity and encourage infiltration.
 - ✓ Infiltration - allowing water to percolate into the ground rather than running across the surface.
 - ✓ Plant absorption and transpiration – the movement of water from the soil into plant roots, up through the stems and leaves and the release of water vapor through the stomates to the atmosphere (Figure 2-1).



- Techniques used to control runoff:
 - ✓ Berm - A stabilized mound of dirt or stone to create a diversion and/or redirect water flow.
 - ✓ Check dam - A small mound of stabilized dirt or stone that breaks up the flow of water in a drainage ditch or trench to slow down velocity and allow for the settling of heavier materials.
 - ✓ Cut-in (or Cut-out) - A small trench that diverts water out of an existing channel, to be treated/infiltrated to prevent a significant volume of water from accumulating as it runs down a driveway, walkway or path. Multiple cut-ins may be required for long distances or high slopes.
 - ✓ Infiltration trench - A dug-in trench commonly used for roof runoff that allows for storage of runoff and encourages infiltration into the ground.
 - ✓ Plunge pool - A dug-in hole stabilized by stone, typically placed in a drainage ditch or trench. This allows water to fall below the level of the surface to slow the runoff velocity and capture heavy particles. These are often constructed in a series along a sloped route.
 - ✓ Rain garden - A shallow infiltration basin planted with water tolerant plant species, designed to capture concentrated runoff. Rain gardens are designed to pond water for just few hours at a time, allowing it to be taken up and transpired by plants or infiltrate into the ground.
 - ✓ Swale - A stabilized trench that can act to store water (detention), sometimes also engineered to enhance infiltration.
 - ✓ Vegetative buffer - A relatively flat area stabilized with vegetation that allows water flow to spread out, slow down, infiltrate and be filtered by the soil, and/or be intercepted and transpired by plants.

- ✓ Waterbar - A diversion device that diagonally crosses a sloped trail, path or road to capture and divert runoff to the side. Commonly made of a log, a stone, a small, reinforced drainage channel, or a partially buried flexible material, a waterbar is most useful for small contributing areas (watersheds less than one acre) that receive foot and vehicle traffic. Waterbars are spaced according to the slope of the land.

- Following the flow:

- ✓ Paying attention to how water flows (or will flow) into, over and through your site before, during and after development or landscaping, is critical in determining current and potential negative impacts. Some questions you'll want to answer before proceeding:
 - What is the extent of lands and roads above the site that contribute runoff water, and where does the runoff enter your property?
 - Where are the impervious areas (paved driveways and walkways, roofs, patios, compacted soils, etc.) and piped source (sump, gutters, etc.) from which you generate runoff?
 - Where does that water, along with any additional runoff generated in your new design, run over your site? Is it treated by vegetation, infiltrated or does it accumulate?
 - Where will that water then flow off your site? Does it enter the water body directly?
 - Most importantly, how might you modify your design to take advantage of these factors in creating diversions, detention and infiltration areas?

- Investigate the drainage ways:

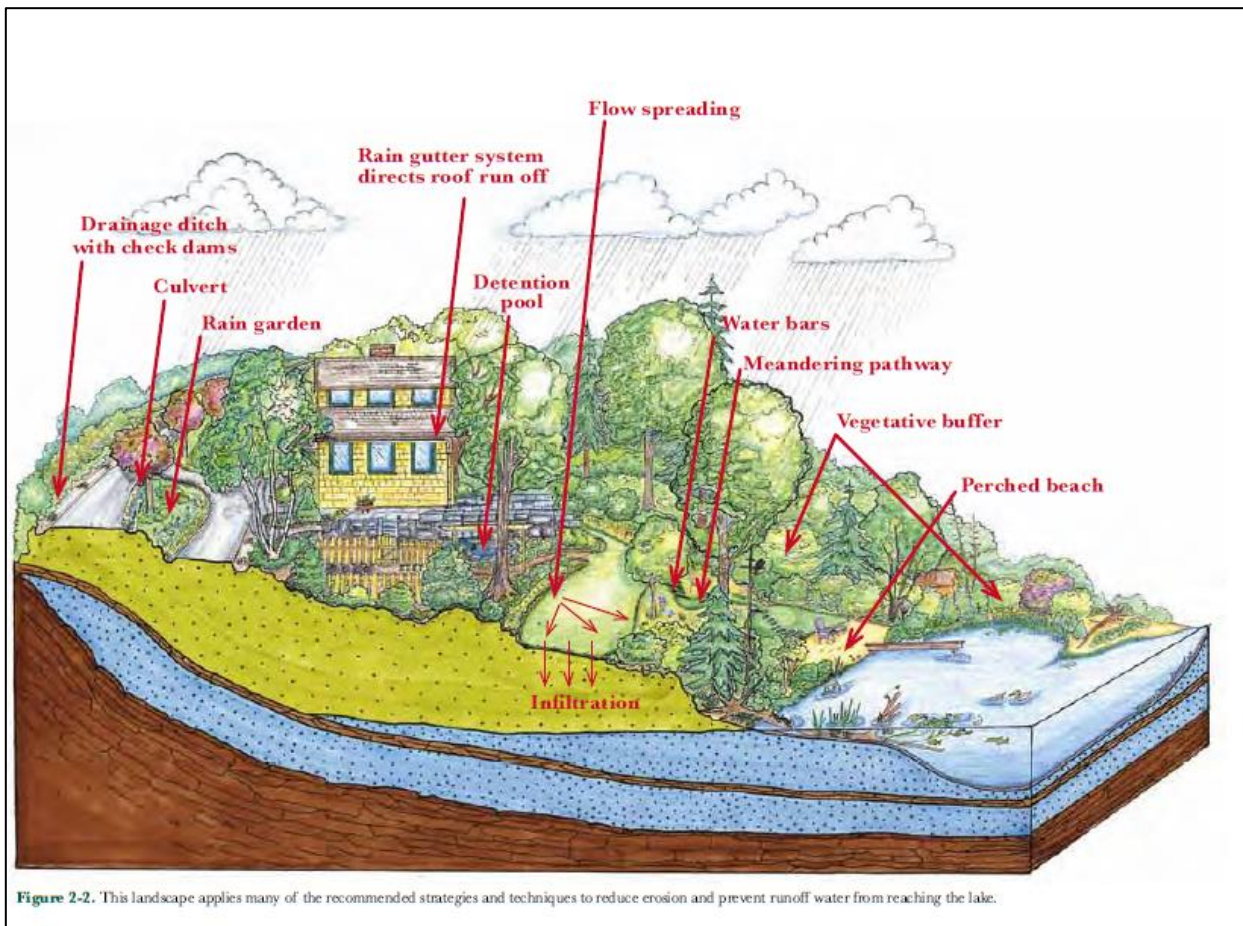
Since water moves downhill, you need to walk your property boundary and note where the major water flows occur after a heavy rainstorm. Does the runoff from abutting roads or a neighbor's driveway flow onto your property? Are there any adjacent steeply sloped lands that rise above the level of your property? Are they extensive enough to contribute water flows during rains and snow melts? Make note of all of these off-site contributors to flow. Also note any occasional or perennial wet areas or streams at your property boundary that encroach on your site.

- Investigate onsite runoff generation:

- ✓ Note any wet areas or seeps on your property. Now consider how your house and current landscaping features generate runoff. It is always easy to point uphill and blame runoff on other properties, but most people are surprised at how much runoff their own site creates, even in low- density development. Be aware whether you have areas that divert runoff onto neighboring properties as well.
- ✓ Take inventory of all paved and compacted areas, such as driveways, patios and walkways. Can you find evidence of water flow moving off these areas and heading downhill?
- ✓ You may see just a small area of sheet erosion, indicated by the appearance of worn-down gravelly areas with small stones and roots showing because finer soil particles have been washed away. Or you may see rills, visible channels where water has eroded away materials a fraction of an inch to a few inches deep. In the worst cases, you'll find gullies where water flows through channels deep enough for you to step into them.
- ✓ The potential for erosion and runoff increases with site steepness, area of impervious surfaces, and size of contributing watershed area (land above your site).
- ✓ Investigate the point sources of flows on your property from culverts, drain pipes, and hoses, as well as rain gutters, sump pumps, and tile drainage outlets. These concentrate diffuse flows that need treatment and diversion to ensure they don't contribute to runoff. If the house doesn't have gutters, look for areas where the roof design intercepts and dumps rainwater onto the property.
- ✓ Account for any paths, trails and cleared areas that lead to the water. Lakeshore properties almost always have pathways and cleared areas that allow runoff to flow directly into the water body. In the worst cases, a driveway at the top of the property allows water from the road above and the gutter runoff to collect and concentrate, flowing down a pathway directly into a cleared beach area and into the water, often taking a lot of sand with it.
- ✓ Note how the paths follow the slope of the land. Meandering paths may function to break up runoff before it concentrates, but straight downhill paths encourage flow directly to the water. Also, note the flow-contributing areas that lie above the access area or beach. Do swaths of vegetation above help break up the flow, or does the water pretty much flow straight down and onto the area below?
- ✓ Finally, look for areas where water tends to pond after it rains. Even flat areas may pond water if the soils don't drain well or if there is a lot of shallow ledge or hardpan present. Be sure to keep track of these areas and prevent additional water from reaching these locations.

- Minimize and divert runoff:






- ✓ Significant flows coming onto your site may create runoff and erosion problems. Your design should take into account all flows that will come in contact with your newly landscaped area, as well as those flows that may cause runoff concerns in other areas on your property (or your neighbor's).
- ✓ Of all the methods that can help deal with these situations, diversion and flow-spreading are the most reliable. If you can treat all of the incoming runoff by diverting it and spreading it out over a stable vegetated area before it leaves the property, then by all means do so. However, in situations of high runoff flow coming from off-property sites such as roads, diverting some of the flow may be warranted to keep it from entering your property. The sources of offsite runoff can be diverse and you may not be able to take action without involving neighbors, road associations, and municipalities, since road-drainage diversions and treatment systems require professional design and installation.



- ✓ Use what you have (or can design) to break up, slow down and spread out the flow over or into a vegetated area. The goal is to prevent offsite and onsite flows from accumulating and divert them from impervious areas. You may be able to break up the flow by using shallow channels, stone check dams, small vegetated berms, or alternating areas of low and high vegetation.
- ✓ Simple drainage cut-ins can break the flow and move the water from long driveways and pathways. In more challenging situations—for example, when sites are very steep or narrow—you may need to hire a professional to install a waterbar or similar diversion.
- ✓ If you can't divert the flows coming onto your site and can't find ways to prevent the flow from concentrating to a significant volume, then consider diverting the water into your existing vegetated areas, or create additional vegetated areas, to allow the water to slow down, spread out and infiltrate the ground, thus losing most of its destructive force and most of its pollutant load. For this to work, you need an adequately sized vegetated area with minimal slope.
- ✓ The denser the root systems of the plants in vegetated areas, the greater the volume of water the area can process. Mixed types of vegetation with different root depths will have the greatest impact, as contrasted with monocultures, which grow a single type of plant. However, any type of vegetation is better than a bare, cleared, compacted, or impervious area.
- ✓ The same holds true for dealing with runoff from pavement, roofs, tile drainage, sump flows, and existing drainage ways: capture the water and/or divert it by any means possible (plunge pools, waterbars, berms, swales and drainage trenches) to prevent it from running directly down to the shore. Conditions such as lack of space, steep slopes, and/or proximity to the shore create special challenges to diverting the water from a rain gutter or other concentrated flow. In these situations, consider alternative controls such as rain barrels, storage cisterns and infiltration trenches.
- ✓ You may be able to cut down runoff generation at the source by replacing impervious areas with porous alternatives. For problematic and excessive stormwater volumes you may need to have something engineered to capture water and pump it into other areas for treatment.
- ✓ If you have enough space, consider installing a rain garden, a shallow, dug-in area planted with water-tolerant plant species. Rain gardens can collect a significant volume of water during a storm, allowing the water that doesn't get used by plants to infiltrate the ground quickly and prevent it from becoming runoff. When designed and constructed correctly the surface of a well-designed rain garden will not flood, eliminating concerns about standing water.
- ✓ Properly designed pathways and trails should meander across the slope and allow each segment to throw water off the trail, rather than letting it flow in a straight path, accumulating as it moves downhill. The best trails are those that follow the ridges and contours of the property. Some low vegetation planted at the corners of the meanders or staggered alternately on the sides of steeper pathways will help break up, capture, and slow down the flow of water as it moves downhill.

- ✓ To maximize water quality protection as you consider the ways you want to use and enjoy your waterfront property, the key is to remove as little vegetation as possible. Plan to stabilize a major portion of the lakeshore area with a good mix of plants. The more protective vegetation you remove from near the shore, the more you increase the area's potential for transporting pollutants to the lake or stream. Removing taller plants also opens the shore area to receive more sunlight. Exposure to more sun heats up the water, making it less desirable for aquatic organisms and more conducive to submerged and emergent weed growth, including exotic invasive species.
- ✓ Where you locate the water access area also is important. Areas that don't receive significant runoff from the land above make the best locations for minimizing potential impacts. Water access areas that lie directly below a runoff flow may allow the runoff to reach the water without any reduction in impact. If you have no choice of access location, try to create a diversion of the flow away from the shoreline opening and into a more vegetated area using one or more of the approaches discussed above.
- **Structural approaches:**
- ✓ Most structural modifications for dealing with flow and runoff require professional design and installation. However, nonprofessionals might try one or more of these simpler approaches before calling in the pros:
 - Clear existing drainage ways of accumulated materials, including loose sediments and litter, before the snow melts and the spring rains arrive. Encourage vegetative growth in these drainage ways however, as the vegetation removes sediments and pollutants from the water as it passes through.
 - Break up the water flow by alternating small berms or sediment logs down a sloped area, diverting water off into vegetated areas before it can accumulate in significant volume.
- **Making a difference:**
- ✓ With the knowledge of how water flows over and currently runs off your site, you can now consider adding water diversions, as well as vegetative buffers and infiltration areas into your landscape designs to take advantage of the water-treatment properties of vegetation.
- ✓ A typical small lakeshore lot on a moderate slope with conventional development (house, forest cut for lawn, paved driveway) can increase water runoff, phosphorus pollution and sediment erosion about 5 times, 7 times and 18 times respectively compared to an undisturbed, forested lot.
- ✓ By growing out the lakeshore buffer (50 feet) and infiltrating the roof runoff using trenching or a rain garden, the impacts can be reduced down to 1.5 times the runoff, 2 times the phosphorus and less than 3 times the sediment over the undisturbed lot. This is a significant reduction by using only two of the practices discussed above. Adding other water conservation practices could result in even more pollution reductions, not to mention the benefits to wildlife and lakeshore integrity.

Source: Adapted from: “*Landscaping at the water's edge: an ecological approach, a manual for New Hampshire landowners and landscapers*” – University of New Hampshire-Cooperative Extension.

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